

Attractive Arcade-Based Platform Approach to Exam Preparation

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Abstract. This article describes the motivation, development and results obtained with the use of an arcade with a game designed to prepare for the selection process for admission to the Instituto Federal Catarinense. Realizing the importance of using technologies for educational purposes, combining the needs that schools have to prepare their students for academic life, FlipIFC presents itself as a possibility to make preparation attractive and stimulating. The platform developed with the Java programming language, the MySQL database and using the knowledge of the technical course for the development of the arcade machine, showed positive results, confirming the effectiveness of the proposal in attracting students and assisting them in the test preparation process.

Keywords: Arcade machine platform · Educational technology · Learning technologies

1 Introduction

During a student's school life, we noticed the presence of several exams and tests, for which the school must prepare its students. In Brazil, one of these exams is the Classification Examination for the Instituto Federal Catarinense (IFC), which seeks to assess students' knowledge and classify the best positioned to enter the institution. It is up to the school and the teachers to look for ways to prepare the student for these exams, creating and looking for didactic and methodological resources that promote better learning and lead to a good performance, such as the application of simulations and preparatory classes.

IFC aims to train professionals qualified to perform efficiently, functions in the various sectors of the Brazilian economy. IFC has 15 campuses spread across Santa Catarina's state, offering education in several areas from initial to post-graduation [6].

The use of technology as a tool that contributes to the contemporary educational process is the subject of several studies, which demonstrate, in its results,

© Springer Nature Switzerland AG 2020
O. Gervasi et al. (Eds.): ICCSA 2020, LNCS 12253, pp. 576–584, 2020.
https://doi.org/10.1007/978-3-030-58814-4_44

the success of this practice. Currently, there's no one educational technology designed to prepare for the classification exam. Bringing the idea out of the IFC - Campus Avançado Sombrio (IFC-CAS), the FlipIFC project arises, which aims to build an arcade machine platform with a game for solving questions of the IFC admission exam.

The games fit into an educational context aiming to stimulate and motivate individuals to perform tasks, behavior changes and learning. The use of that is a promising approach due to their abilities to teach and reinforce not only knowledge but skills such as problem solving. They utilize a number of mechanisms to encourage people to engage with them, often without any reward, just for the joy of playing and possibility to win [4]. This practice became known as gamification.

Therefore, bringing tools to the school environment that assist in the learning process can be considered an effective and efficient method of achieving the institution's objectives [5]. Gamification is a way of transforming school content into technology, with the aim of stimulating and motivating individuals.

Given this context, in this article, the focus is to discuss the use of FlipIFC and its evaluation. In particular, a gamified learning activity is presented in which FlipIFC is used and assesses its ability to influence students to improve. In addition, this proposal aims to collaborate with the divulgation of the institution, familiarizing students with exam model.

2 Related Work

The research in educational technology has grown from investigations attempting to apply that media and technology are effective tools for instruction, to investigations to examine the applications of processes and technologies to the improvement of learning [8]. Computer games and educational technology games have the potential to improve instruction. The idea among educational researchers is that computer games by themselves are not sufficient for learning to occur [13]. There are several proposals for educational and learning technologies, based on games, available for mobile devices or online access.

Gamification is an effective approach to make positive change in students' behavior and attitude towards learning, to improve their motivation and engagement [5,9]. A broad definition of gamification is "the use of game design elements in non-game contexts" [3]. With this, can affect students' results and understanding of the educational content and create conditions for a learning process. The gamification's use in order to make the content more attractive and engage users is a efficient approach [10] that combine intrinsic motivation with extrinsic one in order to raise motivation and engagement [15].

Quiz-based games are already known, used and analyzed to verify impact on students. A gamified quiz software tool was used in [2] as objective was to develop an approach in which gamification is used to motivate and enhance learning. The results showed that the proposed gamification implementation to improve learning has positive effects.

Previously, a survey based on an arcade platform showed that it is possible to integrate in an educational environment. In [1] a quiz game integrated into an arcade platform applied at an educational institution was proposed, which helps students to take an exam. It shows that structure was interesting and accepted by the users. The platform proposal was made available to students and there was a notable interest not only in using the game as a study. Being one of the goals of gamification, in addition to learning they also reported entertainment, exercising their knowledge without realizing it. This paper is based on this project. However, this being an initial survey, other forms of assessment can be done to measure the impact of different types of learning. Reference [14] suggests that quiz-based games there may be flaws that require further investigation to assess student learning.

The use of arcade in the educational area is already used in a version of Tux, of Math Command or TuxMath, an educational arcade game for learning mathematics [7]. It is an educational game in a space invasion where enemies are replaced by meteors accompanied by mathematical calculations. Besides, the study proposed in [7,12] shows that using TuxMath as an educational tool or teaching aid has a significant positive effect on students' learning.

Reference [11] reports that the use of arcade machines is old and as a form of entertainment, which can attract attention because of the distinguished structure. They lost space by computer games and consoles. Previously, games developed for arcade machines attracted attention, based that arcade developers focused on creating fast-moving, time-limited games that do not involve detailed story or character development [11]. In practice, it can be assumed that they often can and will give rise to playful behaviour.

3 Proposed Approach

This project started with an application of a questionnaire with 95 middle-level students from the Instituto Federal Catarinense - Campus Avançado Sombrio (IFC-CAS) in the first half of 2018. The questionnaire asked students about the period before joining at IFC-CAS. The objective was to analyze the efficiency of the institution's divulgation process and the students' interest in using games for admission to IFC. The divulgation process can be explained in the different ways that students knew IFC. Moreover, their interest based on using a platform like the one proposed in this article for the classification exam. The results of the questionnaire were 89.5% divulgation could be better, 72.6% and 24.2%, respectively, for yes and maybe would use.

Students use different ways of preparation for any exam. Confirming the current divulgation is not enough according to the data above, students were asked about the method for exam preparation: 71.6% by reviewing exams from previous years on their own, 3.2% by reviewing exams from previous years in the classroom, 13.7% by studying the exam's theme and 26.3% there was not exam preparation.

Based on this answers, the platform would be well received by students and through the positive results presented in the previous section, becomes a good educational technology to be applied as a proposal directed to federal institutions. In addition, as method applied by this project is in line with preparation method used by most students and the deficiency of divulgation of the institution inside schools of the city, there is a favorable field. The interest in using a game with questions from this classification exam being made available on school premises reinforced the proposal for a game with questions and answers applied on an arcade platform.

The game interface was developed in the Netbeans IDE environment using the JAVA programming language. For the storage of data of the questions and of the players was used the database manager MySQL Server. The integration between the interface and database has resulted in a set of questions from IFC's previous tests, following the same exam standards.

The last stage of the project was to install the game on a computer and adapt it to an arcade. The structure was made with wood material and has a joystick and buttons, both connected to the computer. Thus, the generated platform has a question game for the IFC, named FlipIFC.

This proposed approach was developed based on an arcade platform machine to serve and reach more students in the educational environment, in addition to presenting an attractive structure, which would increase the possibility of more students using it. In addition, it was developed to be applied on school premises, without the need for web or mobile applications.

4 Experiments and Results

This section presents details of the game and the results obtained after the use of FlipIFC, during the 30-day period, before the 2019 IFC-CAS's classification exam.

4.1 FlipIFC

The FlipIFC project is a technological and methodological resource platform capable of assisting the study of IFC's admission exam. It was developed as a game, to run on an arcade machine in a way that can be a attractive method.

Proposed Game. The purpose of this work was to create a game with questions and answers to be applied in a elementary school environment. It was produced through software development tools used in high school integrated computer science technical course at IFC-CAS.

The main screen of game has two rankings, the first one has a general ranking of the five best placed in the whole school and the other is a weekly ranking separated by knowledge area with five best players as shown in Fig. 1:



Fig. 1. Game's home screen.

The weekly ranking title changes according to the area of the week. By default, to exam of IFC, the knowledge areas are Portuguese Language, Mathematics, Human Sciences and Natural Sciences. Both rankings show the user's class, name, hits and misses. The weekly ranking contains only the hits and misses of the week, while the overall ranking contains all player's hits and misses. In addition the ranking, the home screen displays the project logo and instruction to start the game. As soon as any key is pressed, the login screen is displayed for player identification, which is to access and log in to the game.

The log in screen consists of a dialog box requesting the user code, one character icon on the left and one on the right. The user code is a number chosen by the players themselves. For users the number must contain six digits. Such a measure, as well as the request to avoid passwords composed of sequential or repetition numbers was taken to prevent the occurrence of repeated passwords. If the user attempts to enter the game without entering their code, an alert message prompts them to enter the number.

After identification, a screen with a countdown of five seconds appears to the player, as a way of preparation to receive the questions to be solved. So, the player is directed to the first question followed by alternatives. It is important to emphasize that knowledge area of the questions changes weekly. The player choose the alternative with the joystick and hit the enter key on the arcade machine. After that, the game checks if selected alternative is correct and shows the correct answer, like the Fig. 2.

This screen consists of the following items: name of the logged player (here omitted), time left to answer the question, area of knowledge question, statement of the question and five alternatives. In green, the correct alternative is identified. In red, the incorrectly chosen alternative. A character reacts according the result of the move, appears in the lower left corner. Both right and wrong question, the user is directed to the second question of the day, if not already answered. If the user doesn't answer the question within two minutes, the correct answer turns green and an error is counted. The questions are asked randomly according to the weekly knowledge area and it is not allowed to repeat questions for the same user.

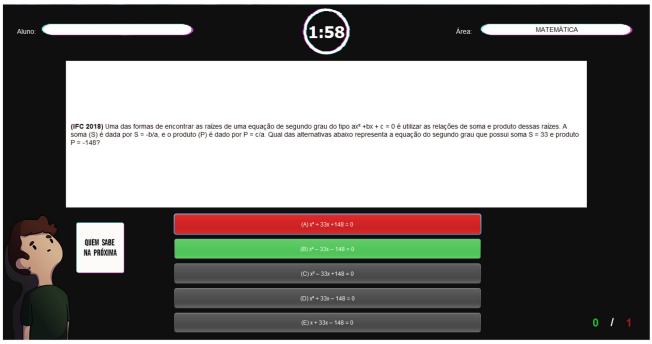


Fig. 2. Game's answer screen.

The many playful aspects included to the platform aim to make the experience more interesting, presenting a friendly environment and easy usability. Aspects worked in gamification and educational games was used, as appropriate to the context, based good results obtained as methodologies in education's field.

Arcade Platform. As described in Sect. 2, using an arcade game idea was tried already and achieved great results. This proposal tends to be a differential compared to other proposals, as it attracts the attention of the public, especially the younger ones. Therefore, to justify the idea of producing such a platform, it is because there's no platform with a software aimed at preparing admission to IFC. The intrinsic motivation generated through existing mechanics of this approach is represented maily engagement and competition.

Gamification implies an interaction with other participants, in this case with a ranking-based. Using an arcade platform at an educational environments can make an attractive possibility of fun and engaging, without undermining its credibility. Gamification helps students gain motivation towards studying, and because of the positive feedback they get pushed forwards and become more interested and stimulated to learn. In this case, it makes possible to increase exam divulgation of institution.

The arcade's assembly was performed using a desktop computer, an ordered wooden structure and a kit of buttons and joystick, which are responsible for all actions the game. Figure 3 shows the final format of the FlipIFC platform. Figure 3, positioned on the left, the joystick is shown. The center button represents an "OK" or "Enter" key, in which the player confirms the access or the alternative chosen in his attempt. The set of buttons on the right are positioned similar to a numeric keypad and with a "Clear" button, these are used to perform the individual code to access to the game.

Finally, the structure received stickers to make it even more attractive to users. The stickers also fulfill the function of informing the rule of daily moves: one move per day, two questions per move, two minutes per question.

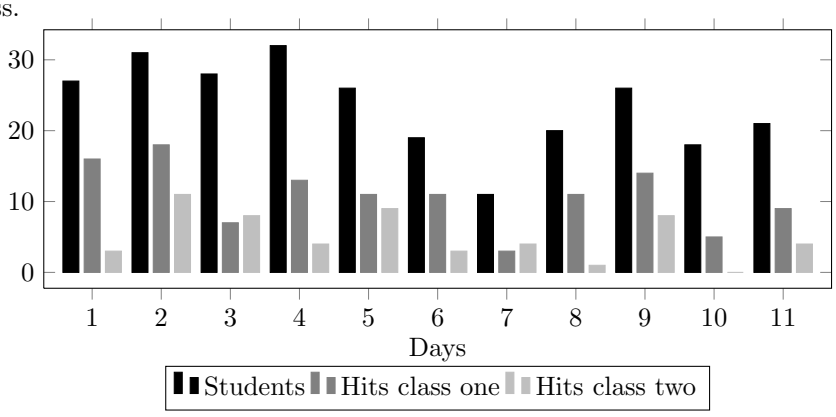


Fig. 3. Final structure of FlipIFC.eps

4.2 Analysis and Discussion of Experiments

Institution's divulgation objectives, scientific development and support for students' studies were achieved. The arcade machine platform was implanted in a municipal school at Sombrio (Santa Catarina - Brazil) for a period of 11 d for analyze and tests, being available to the registered users. It is important to note that students were not forced or encouraged to use the platform, they played for their own interest and will. In general, the results gained were very positives. After the platform's application in this period, these data could be analyzed based on the 47 registered players. Of these, 83% played at least once and, from these, 97.5% made more than one move.

FlipIFC reached 259 moves, obtaining 518 responses. This result stored were counted with an average of 23.55 plays per day, a standard deviation of 6.31. In relation to all participating students, the average of correct answers for the questions was 33.4%, which may present a lack of preparation by the students. The graph below shows the amount of students participating per day and amount of hits per class.



Based on these data, there was greater engagement and use in the first days, which can be considered by the novelty inserted in the school. The fall needs to be analyzed for what reason, which was not verified in this work. But, it can be something related to the school, since there was an increase in student participation in the last days of the project. A dedication was perceived by the students who are completing elementary school, who would be the initial target audience. The low rate of correct answers may have been due to the fact that students were not aware of the admission exam, a fact verified through the questionnaires. After this period, a questionnaire with closed questions was applied with the classes participating in the school and a total of 47 responses were obtained. The questions were intended to find out the students' opinions about the system and the experience they had using FlipIFC in addition to how it contributed, or not, in preparing for the IFC-CAS's admission exam. The three main questions asked are described below:

Question 1. What do you think about the appearance of the FlipIFC arcade machine platform?

Question 2. Do you think is FlipIFC a good educational technology for joining IFC?

Question 3. Have you ever had any contact with the admission exam or the exam questions before exam?

According to the responses of the participants 92% answered is atractive for question 1, 96.4% answered is a good educational technology for question 2 and 84.7% answered never had a contact for question 3. Analyzing these data, can be seen that few students had access to the IFC exam model. Therefore, they were asked whether it helped them to know the exam using FlipIFC, through the question 4.

Question 4. Did FlipIFC contribute in any way to the preparation of the exam or familiarization of the questions?

Based on the question 4 about how the game contributed to the preparation for the admission exam, 68.8% of the students answered that the platform had helped and gave them the opportunity to have contact with the exam questions template in addition to helping them prepare for it. Besides that, 13.8% responded that the game helped to train their knowledge for the exam. Which considers this approach as a possible tool to use, considering it as an additional tool in elementary education.

5 Conclusion

This work presented the development of a game as a way of preparing for the IFC classification exam. For those interested in the exam, the system provides prior contact with the test, seen by the result of the questionnaires. In addition, it allows

the student on his own to check the effectiveness of his preparation and knowledge. Through the results it can also be seen that the platform was well accepted, based on the number of attempts made by the students. The amount of incorrect answers collected by the system can reflect on the students themselves, who, in turn, can spend more time preparing for the exam once the need is identified.

Educational games already used as strategies to help students' difficulties, improving performance and helping in the construction of knowledge, are also relevant for their playful potential, drawing attention to the theme worked on. Thus, FlipIFC proposes to evaluate the result of using this technology in municipal schools, as a tool for students to enter quality education.

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